Earth, Moon and Mars Balloons

TEACHER SECTION

Grade Level: 5-8
Subject(s):
Space Science, Mathematics
Prep Time:
10 minutes
Duration:
One to two class periods
Materials Category:
Special

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Objective

To construct a scale model of the Earth-Moon-Mars system in terms of planetary size and to discover how far one might have to travel to get to the Moon or Mars.

National Education Standards

Science

Earth and Space Science

Structure of the Earth system

Mathematics

Compute fluently and make reasonable estimates

Select appropriate methods and tools for computing with fractions and decimals from among mental computation, estimation, calculators or computers, and paper and pencil.

Understand patterns, relations, and functions

Represent, analyze and generalize a variety of patterns with tables, graphs, words and, when possible, symbolic rules.

Relate and compare different forms of representation for a relationship.

Identify functions as linear or nonlinear and contrast their properties from tables, graphs or equations.

MATERIALS
(for a class of 30)

- *One bag of blue balloons (at least 10 per bag)*
- *One bag of white balloons*
- *One bag of red balloons*
- *Rulers or measuring tape*
- *Student Pages*

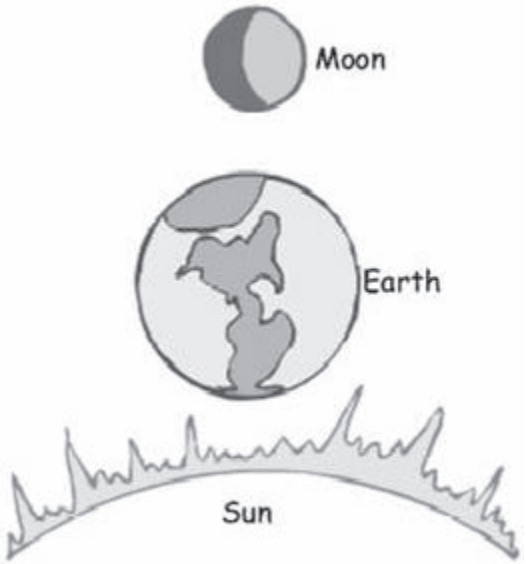
Pre-lesson Instructions

- Obtain balloons. If you cannot find red, white and blue balloons, you can substitute a few other colors. Earth can be blue or green, Mars can be red or orange, and the Moon can be white or yellow. Balloons should be available at your local grocery or party supply store.
- Duplicate the Student Pages (one per group).

Background Information

How big is the Moon? How far from Earth is the Moon? Earth science and astronomy books depict a Moon that is much closer and much larger than in reality. The example to the right is typical of what is found in textbooks.

This balloon activity will allow students the opportunity to construct a scale model of the Earth-Moon system, both in terms of planetary sizes and distances. In addition, students make a scale model of Mars and discover how far one might have to travel to visit the most Earth-like planet in our solar system. This activity is also a good introduction at the beginning of a unit on the solar system to preassess student knowledge of planetary distances.



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Guidelines

1. Discuss Earth's size relative to the Moon and to Mars. Determine what misconceptions students may have.
2. Divide students into three groups, and distribute Student Pages and balloons. One group should have "Earth" balloons (blue), one group should have "Mars" balloons (red) and one group should have "Moon" balloons (white).
3. Tell students that the Earth balloon should have a diameter of 20 centimeters (cm). Have them follow the instructions on their Student Pages to determine the scale. Ask students with Earth balloons to inflate their models to this scale. (Obviously, the balloon is not a perfect sphere, but neither is the Earth.)
4. Ask students to look at the Student Pages, and to calculate the sizes of the Moon and Mars using the same scale as the Earth model. The Moon should be about 5 cm and Mars about 11 cm.
5. Have students inflate their Mars or Moon balloons.
6. Ask students, "At this scale, how far apart are the Earth and the Moon?" The diagrams in common textbooks might lead many of them to suggest that the Moon balloon should be held less than a meter from the Earth balloon.
7. Have students use the information on the Student Pages to calculate the distance from the Earth to the Moon at the same scale as the balloon models. The distance is about 6 meters. Have students holding the Earth models stand at one side of the room and students with the Moon models stand about 6 meters away.
8. Point out to students that they now have a scale model of the Earth-Moon system. The distance between the two is the distance traversed by the Apollo astronauts who went to the Moon in the 1960s and '70s.
9. Compare the size of the Mars model with the Earth and Moon models. Look at the distance between the Earth and the Moon.
10. Ask students how far away they think Mars will be at this scale. Have students attempt to demonstrate it in the classroom.
11. Have students use the information on the Student Pages to calculate the distance to Mars at this scale. Note: This is an average distance to Mars. This distance varies depending on the relative positions of Earth and Mars in their orbits around the Sun. The answer is about 120,000 cm, or close to three-quarters of a mile! Have students identify a local landmark that is about three-quarters of a mile away.

Discussion / Wrap-up

- Discuss the relative distance between the Earth and Mars in the context of a human trip. How long did it take for Apollo astronauts to get to the Moon? Three days. How long would it take for astronauts using similar technology to get to Mars? Mars Pathfinder, which launched December 1996, arrived at Mars on July 4, 1997 (seven months). Mars Global Surveyor, which launched in November 1996, arrived at Mars in September 1997 (11 months).

Extensions

- Ask the students to make models of one of the martian moons, Phobos, at the same scale as the balloon models. They can calculate its scale diameter using the information on the Student Pages. It turns out that at this scale, Phobos is about the same size as a small grain of sand!
- Have students convert all metric measurements into the U.S. system.

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Use the information from this table to determine the scale of your Earth balloon and to calculate the size of your other models. Be sure to fill in any missing information from the tables. Measurements are presented in kilometers (km) and centimeters (cm).

Bodies	**Average Distance** (km)	**Model Distance** (cm)
Earth	12,756	20
Moon	3,476	
Mars	6,794	
Phobos	22	

To find out what scale your Earth balloon is, divide the diameter of the Earth in km (12,756) by the diameter of the model in cm (20).

12,756 / 20 =

To find the diameters of the other two models, divide the actual diameter by the scale of the models (your answer from the last question).

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Name: _____

Use this table to calculate the distances between the planets.

Bodies	**Average Distance** (km)	**Model Distance** (cm)
Earth to Moon	*384,000*	
Earth to Mars	*78,000,000*	

To find the distance between each of your models, divide the actual distance by the scale of the models.